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Meridional Variations of Stratospheric Temperatures and Hydrocarbon Abundances in Neptune's Stratosphere

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Using TEXES – the Texas Echelon cross Echelle Spectrograph – mounted on the GEMINI North 8-m telescope in October 2007, we mapped the spatial variation of H_2, CH_4, C_2H_2 and C_2H_6 thermal infrared emissions on Neptune. We employ the high spectral and spatial resolution mid-infrared ground-based observations of the ν_4 band of methane and the S(1) line of molecular hydrogen to retrieve detailed information on Neptune's stratospheric vertical and meridional thermal structure. We then use the inferred temperatures to model the emissions of C_2H_2 and C_2H_6 in order to derive stratospheric mixing ratios as a function of pressure and latitude. At R=$\lambda/\Delta\lambda$=80,000, these observations provide the highest spectral resolution of any spatially-resolved thermal-infrared spectra to date. As such, they offer a unique glimpse into the state of Neptune's stratosphere in October 2007. The results are compared with a radiative seasonal model of Neptune to place the observations in some context.

We also present the first high resolution observations of C_2H_4 in Neptune's stratosphere. The spectra, retrieved in June 2003 using TEXES mounted on the NASA IRTF, was never published due to the lack of observations capable of first inferring the temperature of Neptune's stratosphere. We now present an analysis of the observations modeled using an average of the inferred temperature profiles retrieved from the 2007 observations.

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